(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 845 199 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
17.10.2007 Bulletin 2007/42

(21) Application number: **06255230.2**

(22) Date of filing: **11.10.2006**

(51) Int Cl.:
E01D 2/00 *(2006.01)* ***E01D 19/02*** *(2006.01)*
E02D 27/30 *(2006.01)* *E02D 27/30* *(2006.01)*

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **13.02.2006 JP 2006035690**

(71) Applicants:
- **Asahi Engineering Co., Ltd.**
  Kanazawa-shi,
  Ishikawa-ken (JP)
- **Eco Japan Co., Ltd.**
  Ishikawa-gun,
  Ishikawa-ken (JP)

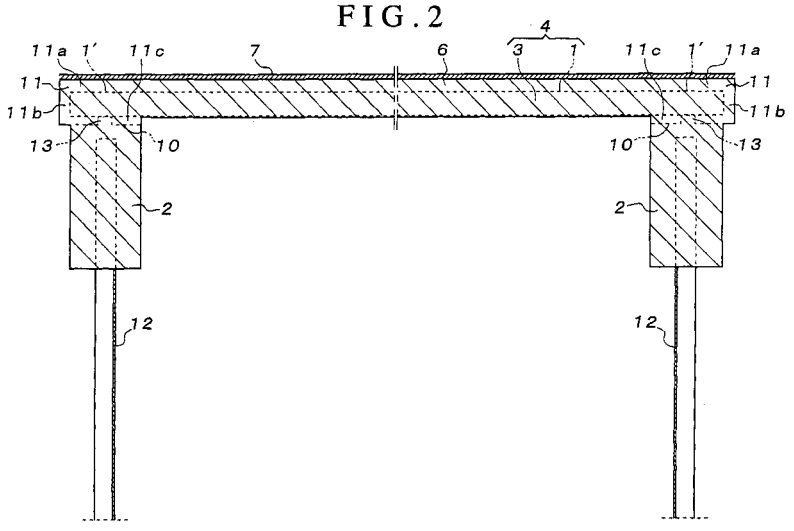
(72) Inventors:
- **Tokuno, Mitsuhiro**
  Kanazawa-shi,
  Ishikawa-ken (JP)
- **Saito, Fumihiro**
  Ishikawa-gun,
  Ishikawa-ken (JP)

(74) Representative: **Rees, Alexander Ellison et al**
Urquhart-Dykes & Lord LLP
30 Welbeck Street
London W1G 8ER (GB)

(54) Floor slab bridge structure

(57) The invention provides a floor slab bridge structure capable of enhancing that strength, with which bridge girders and concrete bridge piers are rigidly joined, effectively suppressing expansion and contraction, deflection, and distortion of the bridge girders, and synergistically enhancing the strength of connection concrete itself against the expansion and contraction, distortion, etc., and being very effective as measures for prevention of collapse of bridge against a large earthquake. Slab concrete (3) is hammer-set between sides of respective bridge girders (1), which are aligned in a bridge width direction, in a length direction of the bridge girders and connection concrete (11), in which bridge girder portions supported on bridge bottom surfaces (10) of concrete bridge piers (2) supporting the bridge girders are embedded, is additionally deposited on the bridge bottom surfaces to form a floor slab bridge structure being a rigid joining structure, in which the slab concrete and the concrete bridge piers are concrete-joined together through the connection concrete.

FIG. 2



EP 1 845 199 A2

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a floor slab bridge structure formed by hammer-setting slab concrete between sides of respective bridge girders, which are aligned in a bridge width direction, in a length direction of the bridge girders and comprising a composite structure of the bridge girders and the slab concrete.

2. Description of Related Art

[0002] Conventional floor slab bridges adopt a flexible joining structure, in which bridge girders are supported on bridge bottom surfaces of concrete bridge piers through rubber bearings and expansion and contraction, deflection, or distortion of the bridge girders are absorbed by the rubber bearings.

[0003] However, such flexible joining structure involves a problem that there is a fear of collapse of bridge against a large earthquake and rubber bearings suffer degradation in function due to aged deterioration and are very expensive to increase in execution cost.

[0004] On the other hand, Patent Document 1 (JP-A-2000-319816) proposes, as a method of construction in place of the flexible joining structure with the rubber bearings, a method of construction, in which bridge girders are supported on bridge bottom surfaces of concrete bridge piers through no rubber bearings and connection concrete, in which bridge girder portions supported on concrete bridge piers are embedded, is additionally deposited on the bridge bottom surfaces to thereby form a rigid joining structure of the bridge girders and the bridge piers every bridge pier through an independent connection concrete.

[0005] However, the method of construction, in which rigid joining is achieved through independent connection concrete additionally deposited every concrete bridge pier, is not functionally effective for strengths for expansion and contraction, distortion, etc. of bridge girders extending long between bridge piers, and difficult to ensure the strength of independent connection concrete itself for expansion and contraction, distortion, etc. of bridge girders, so that the independent connection concrete suffers stress concentration and crack or the like is generated in the bridge girders and the independent connection concrete whereby the structure is difficult to effectively function as earthquake resistant structure against a large earthquake.

SUMMARY OF THE INVENTION

[0006] The invention provides a floor slab bridge structure wherein slab concrete is hammer-set between sides of respective bridge girders, which are aligned in a bridge width direction, in a length direction of the bridge girders to form a floor slab composed of a composite structure of the bridge girders and the slab concrete, and connection concrete, in which bridge girder portions supported on bridge bottom surfaces of concrete bridge piers supporting the bridge girders are embedded, is additionally deposited on the bridge bottom surfaces to form a rigid joining structure, in which the slab concrete and the concrete bridge piers are concrete-joined together through the connection concrete.

[0007] A rigid joining structure is constructed by providing the concrete bridge piers upright on buried foundation pillars, or by striking sheet piles in opposition to a bank while assembling them to construct an earth-retaining wall connected in a bridge width direction, supporting the concrete bridge piers on upper ends of the sheet piles projecting above the surface of the water or the ground, and concrete-joining the bridge piers and the slab concrete through the connection concrete.

[0008] Also, the bridge girders are supported directly on the bridge bottom surfaces of the concrete bridge piers, or supported indirectly on sleeper materials provided on the bridge bottom surfaces, and the sleeper materials are embedded in the connection concrete. As the sleeper materials, it is possible to use concrete sleeper materials hammer-set and formed on the bridge bottom surfaces of the concrete bridge piers, or steel materials, etc.

[0009] Also, as means for reinforcement of a concrete joining structure with the connection concrete, the bridge girder portions supported on the bridge bottom surfaces of the concrete bridge piers and the concrete bridge piers are connected to each other by the connecting bars, which are inserted and embedded in the bridge piers and the connection concrete.

[0010] In the invention, a term for the bridge piers generally refers to an abutment and a bridge pier.

[0011] According to the invention, the connection concrete and the slab concrete cooperate with each other to form a gate type Rahmen structure, it is possible to enhance the strength, with which the bridge girders and the concrete bridge piers are rigidly joined by the connection concrete, to effectively suppress the expansion and contraction, deflection, and distortion of the bridge girders, and to synergistically enhance the strength of the connection concrete itself against the expansion and contraction, distortion, etc., and the structure is very effective as measures for prevention of collapse of bridge against a large earthquake.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1 is a view showing a floor slab bridge, according to the invention, as viewed in cross section on a surface of a bridge girder in a bridge length direction.

Fig. 2 is a view showing the floor slab bridge as

viewed in cross section on a surface of a slab concrete in the bridge length direction.

Fig. 3 is a view showing a further example of a floor slab bridge, according to the invention, as viewed in cross section on a surface of a bridge girder in a bridge length direction.

Fig. 4 is a view showing a further example of a floor slab bridge as viewed in cross section on a surface of a slab concrete in the bridge length direction.

Fig. 5 is a cross sectional view showing the respective examples of a floor slab bridge in a bridge width direction.

Fig. 6 is a cross sectional view showing a gate type Rahmen structure formed by a slab concrete, a connection concrete, and concrete bridge girders on a floor slab bridge of the respective examples.

Fig. 7 is a view showing the respective examples of a floor slab bridge as viewed in cross section on a horizontal surface.

Fig. 8 is a view showing, in enlarged scale, an essential part of a floor slab bridge of the respective examples as viewed in cross section in a portion of a connection concrete, in which connecting bars are provided.

Fig. 9 is a view showing, in enlarged scale, an essential part of a floor slab bridge of the respective examples as viewed in cross section in a portion of a connection concrete, in which suspended reinforcing bars are provided.

DESCRIPTION OF PREFERRED EMBODIMENTS

[0013] Embodiments of the invention will be described below with reference to Figs. 1 to 9.

[0014] As shown in Figs. 1, 3, 5, and the like, a plurality of bridge girders 1 are supported on bridge piers 2 to be aligned in a bridge width direction and slab concrete 3 is hammer-set and formed between sides of the respective bridge girders 1 in a length direction of the bridge girders 1 whereby a floor slab 4 composed of a composite structure of the bridge girders 1 and the slab concrete 3 is formed.

[0015] Fig. 1 shows a single span floor slab bridge comprising bridge piers 2, which are respectively mounted on opposite banks of a river and on which both ends of bridge girders 1 are supported, and Fig. 3 shows a plural span floor slab bridge comprising bridge piers 2, which support intermediate portions of extensions of the bridge girders 1, the invention being embodied for the single span floor slab bridge and the plural span floor slab bridge.

[0016] The bridge girders 1 comprise a steel girder or a concrete girder, and as a preferred example, a floor slab 4 composed of a composite structure of bridge girders 1 and a slab concrete 3 is formed by using H-steel bridge girders 1, which comprise an upper flange 1b at an upper end of a web plate 1a and a lower flange 1c at a lower end thereof, and hammer-setting concrete in spaces defined by the upper and lower flanges 1b, 1c and the web plates 1a between adjacent bridge girders 1 in the bridge width direction to form a slab concrete 3.

[0017] Upper openings 5 extending in a bridge length direction are provided between the adjacent, upper flange 1b, lower openings 5' extending between the adjacent, lower flanges 1c in the bridge length direction are closed by closure members, and concrete is hammer-set, that is, filled in the spaces through the upper openings 5 to form the slab concrete 3.

[0018] The closure members that close the lower openings 5' are removed or caused to remain as they are, after the slab concrete 3 is formed. In those regions, in which a connection concrete 11 described later is hammer-set and which face a bridge bottom surface 10 of a bridge pier 2, however, concrete is hammer-set in the bridge girder-between spaces without closing the lower openings 5' whereby a slab concrete 3 is formed and simultaneously therewith a part of concrete is caused to flow out toward the bridge bottom surface 10 through the lower openings 5' to be concrete-joined to the bridge bottom surface 10.

[0019] Simultaneously, roadbed concrete 6 joined integrally is hammer-set through the upper openings 5 and formed on all the upper flanges 1b and road pavement 7 is applied to an upper surface of the roadbed concrete 6.

[0020] Longitudinal reinforcing bars 16 extending in the bridge length direction and transverse reinforcing bars 8 extending in the bridge width direction are assembled together in the roadbed concrete 6, that is, the longitudinal reinforcing bars 16 and the transverse reinforcing bars 8 are assembled together to be placed on the upper flanges 1b, and suspended reinforcing bars 9 assembled to the transverse reinforcing bars 8 or the longitudinal reinforcing bars 16 are suspended and embedded in the slab concrete 3 through the upper openings 5.

[0021] With the suspended reinforcing bars 9, a reinforcing bar is exemplarily bent in U-shape and both arms thereof are assembled to the transverse reinforcing bar 8. Also, a reinforcing bar is bent in inverted U-shape to form a suspended reinforcing bar 9', a connecting portion of the suspended reinforcing bar 9' is assembled to the longitudinal reinforcing bars 16 or the transverse reinforcing bar 8, and both arms thereof are inserted through at least the upper flange 1b of the bridge girder 1 to be embedded in the slab concrete 3.

[0022] Longitudinal reinforcing bars 16' are assembled to the suspended reinforcing bar 9 or 9' to be embedded in the slab concrete 3, and web insertion rods 17 inserted through all the web plates 1a are embedded in the slab concrete 3.

[0023] Stated again, the H-steel bridge girders, or T-steel bridge girders, or I-steel bridge girders, which are made of a steel material, various concrete bridge girders, etc. are used as the bridge girders 1 to form concrete hammer-set spaces between the respective bridge girders 1 and to form upper openings 5 between upper ends of adjacent bridge girders 1, thus hammer-setting, that

is, filling concrete in the spaces to form the slab concrete 3, and simultaneously therewith roadbed concrete 6 joined integrally is hammer-set through the upper openings 5 and formed on upper surfaces of all the bridge girders 1 to construct road pavement 7 on an upper surface of the roadbed concrete 6. Then the longitudinal reinforcing bars 16 and the transverse reinforcing bar 8 placed on upper end surfaces of all the bridge girders 1 are embedded in the roadbed concrete 6, the suspended reinforcing bar 9, 9' are suspended and embedded in the slab concrete 3, and web insertion rods 17 inserted through webs of all the bridge girders 1 are embedded in the slab concrete 3.

[0024] Of course, a multiplicity of the suspended reinforcing bars 9, 9', the transverse reinforcing bars 8, and the web insertion rods 17 are arranged at intervals in the bridge length direction and a multiplicity of the longitudinal reinforcing bars 16, 16' are arranged at intervals in the bridge width direction.

[0025] Further, a connection concrete 11, in which bridge girder portions 1' supported on bridge bottom surfaces 10 of concrete bridge piers 2 supporting lower end surfaces of the bridge girders 1 are embedded, is additionally deposited on the bridge bottom surfaces 10 to form a rigid joining structure of a gate type Rahmen, in which the slab concrete 3 and the concrete bridge piers 2 are concrete-joined together through the connection concrete 11 and the bridge girders 1 are joined to the bridge piers 2 through the slab concrete 3 and the connection concrete 11 as shown in Figs. 2, 4, 6 or the like.

[0026] That is, after the concrete bridge piers 2 are constructed, the lower end surfaces of the bridge girders 1 are supported on the bridge bottom surfaces 10, and in case of H-steel bridge girders 1, lower flanges 1c thereof are supported on the bridge bottom surfaces 10, and the connection concrete 11 is hammer-set and formed on the bridge bottom surfaces 10.

[0027] As shown in Figs. 2 and 4, the connection concrete 11 is concrete-joined to the slab concrete 3 through the upper openings 5 of the bridge girders 1 by making the concrete bridge piers 2 substantially bulky, and covering upper surfaces of the bridge girder portions 1', or upper surfaces of the upper flanges 1b in case of H-steel bridge girders 1, with a top 11a of the connection concrete 11, that is, embedding upper ends (the upper flanges 1b) of the bridge girders 1 in the top 11 a of the connection concrete 11. The top 11 a of the connection concrete 11 constitutes a part of the roadbed concrete 6.

[0028] Further, as clearly shown in Figs. 2, 4, and 7, bridge girder end surfaces of bridge length ends are covered by rear sides 11b of the connection concrete 11, that is, the bridge girder end surfaces are embedded in the rear sides 11b, and the connection concrete is concrete-joined to the slab concrete 3 through end openings at the bridge girder end surfaces. The slab concrete 3 on the bridge girder portions 1' constitutes a part of the connection concrete 11.

[0029] Further, outer side surfaces of the bridge girder portions 1' in the bridge width direction are covered with left and right sides 11d of the connection concrete 11 in the bridge width direction. That is, the outer side surfaces are embedded in the left and right sides 11d.

[0030] Therefore, there is provided a structure, in which the floor slab 4 of the composite structure is bridged and connected between the respective connection concretes 11.

[0031] As shown in Fig. 3, the concrete bridge piers 2 are provided upright on buried foundation pillars 18, and as described above, a gate type Rahmen structure is constructed, in which the connection concrete 11 concrete-joins (rigid-joins) between the bridge piers 2 and the slab concrete 3 and the bridge girders 1 are rigidly joined to the bridge piers 2 through the slab concrete 3 and the connection concrete 11.

[0032] Also, as shown in Fig. 1, a gate type Rahmen structure is constructed in a unique method of construction by striking sheet piles 12 in opposition to a bank while assembling them to construct an earth-retaining wall connected in the bridge width direction, supporting the concrete bridge piers 2 on upper ends of the sheet piles 12 projecting above the surface of the water or the ground, concrete-joining (rigid-joining) the bridge piers 2 and the slab concrete 3 through the connection concrete 11, and rigid-joining the bridge girders 1 to the bridge piers 2 through the slab concrete 3 and the connection concrete 11.

[0033] A structure is provided, in which steel sheet piles made of a steel sheet having joints on both side edges as shown in the figure are used as the sheet piles 12, a multiplicity of the sheet piles 12 are connected together by the joints and struck to form a sheet pile base and the earth-retaining wall, and the concrete bridge piers 2 are supported on an upper end of the sheet pile base.

[0034] Alternatively, a structure is provided, in which a multiplicity of sheet piles 12 made of a steel column or a concrete column are struck to form a sheet pile base and the earth-retaining wall, and the concrete bridge piers 2 are supported on an upper end of the sheet pile base.

[0035] The bridge girders 1 are supported directly on the bridge bottom surfaces 10 of the concrete bridge piers 2, or sleeper materials 13 are provided on the bridge bottom surfaces 10 and the bridge girders 1 are supported on the sleeper materials 13, that is, the bridge girders 1 are supported indirectly on the bridge bottom surfaces 10 through the sleeper materials 13, and the sleeper materials 13 are embedded in the connection concrete 11.

[0036] Stated in detail, concrete hammer-set through the upper openings 5 is filled in the bridge girder-between spaces to form the slab concrete 3 and to simultaneously flow onto the bridge bottom surfaces 10 through the lower openings 5' to concrete-join between the slab concrete 3 and the concrete bridge piers 2.

[0037] Accordingly, the connection concrete 11 hammer-set and formed on the bridge girder portions 1' on

the bridge piers 2 constitutes a part of the slab concrete 3.

[0038] Spaces are defined between the floor slab 4 and the bridge bottom surfaces 10 by interposing the sleeper materials 13 therebetween, connection concrete 11 is filled in the spaces through the lower openings 5' to be concrete-joined to the bridge bottom surfaces 10, and a bottom 11c of the connection concrete 11 filled in the spaces covers lower surfaces of the bridge girder portions 1', or lower surfaces of lower flanges 1c in case of H-steel bridge girders. That is, the lower flanges 1c are embedded in the bottom 11c of the connection concrete 11 and simultaneously therewith the sleeper materials 13 are embedded in the bottom 11c of the connection concrete 11.

[0039] Also, in the case where the sleeper materials 13 are not interposed, a part of the slab concrete 3 flow onto the bridge bottom surfaces 10 through the lower openings 5' to be concrete-joined to the bridge bottom surfaces 10.

[0040] Sleeper materials made of H-steel, or sleeper materials made of concrete are used as the sleeper materials 13. As a preferred example, there are provided concrete sleeper materials 13 deposited integrally on the concrete bridge piers 2 from substantially central portions of the bridge bottom surfaces 10.

[0041] Further, the sleeper materials 13 are provided independently every bridge girder 1, and the sleeper materials 13 successively extending in the bridge width direction are provided such that, for example, the concrete sleeper materials 13 successively extending in the bridge width direction are provided integrally with and transversely to the concrete bridge piers 2.

[0042] In case of H-steel bridge girders 1, the lower flanges 1c are supported directly on the bridge bottom surfaces 10 of the concrete bridge piers 2, or supported on the sleeper materials 13 provided on the bridge bottom surfaces 10, that is, the H-steel bridge girders 1 are supported indirectly on the bridge bottom surfaces 10 through the sleeper materials 13, and the sleeper materials 13 are embedded in the bottom 11c of the connection concrete 11.

[0043] Connection concrete 11 is filled in spaces defined between the floor slab 4 and the bridge bottom surfaces 10 by the sleeper materials 13, in other words, spaces defined between the lower flanges 1c of the H-steel bridge girders and the bridge bottom surfaces 10, through the lower openings 5' to be concrete-joined to the bridge bottom surfaces 10, and the bottom 11c of the connection concrete 11 filled in the spaces covers lower surfaces of the bridge girder portions 1', or lower surfaces of the lower flanges 1c in case of H-steel bridge girders. That is, the lower flanges 1c are embedded in the bottom 11c of the connection concrete 11, and simultaneously therewith the sleeper materials 13 are embedded in the bottom 11c of the connection concrete 11.

[0044] Likewise, in the case where T-steel bridge girders, or I-steel bridge girders, which are made of a steel material, and concrete bridge girders of various configurations are used as the bridge girders 1, the lower end surfaces of the respective bridge girders 1 are supported directly on the bridge bottom surfaces 10 of the concrete bridge piers 2, or the lower end surfaces of the bridge girders 1 are supported on the sleeper materials 13 provided on the bridge bottom surfaces 10, that is, the bridge girders 1 are supported indirectly on the bridge bottom surfaces 10 through the sleeper materials 13, and concrete is filled in the spaces through the lower openings 5' to embed the sleeper materials 13 in the bottom 11c of the connection concrete 11.

[0045] Also, as a concrete joining structure with the connection concrete 11, that is, means for reinforcement of a rigid joining structure, the bridge girder portions 1', which are supported on the bridge bottom surfaces 10 of the concrete bridge piers 2 and embedded in the connection concrete 11, and the concrete bridge piers 2 are connected to each other by connecting bars 14, which are embedded in the bridge piers 2 and the connection concrete 11 and made of a connecting wire or connecting pipe member. The connecting bars 14 cooperate with the connection concrete 11 to form the rigid joining structure.

[0046] The connecting bars 14 extend longitudinally in the concrete bridge piers 2 substantially over total heights thereof, and upper ends thereof project upward from the bridge bottom surfaces 10, the projecting portions extending through the bridge girder portions 1' and/or a portion corresponding to the slab concrete 3 to be connected to the bridge piers 2.

[0047] For example, in the case where the bridge girders 1 comprise H-steel bridge girders, the projecting portions of the connecting bars 14 are inserted through through-holes provided in the lower flanges 1c and the upper flanges 1b, nuts 15 are threaded onto male thread portions of the connecting bars 14, which project from upper surfaces of the upper flanges 1b, and the nuts 15 are seated on the upper flanges 1b to connect the bridge girder portions 1' to the bridge piers 2.

[0048] Likewise, in the case where T-steel bridge girders, or I-steel bridge girders, which are made of a steel material, and concrete bridge girders of various configurations are used as the bridge girders 1, upper end projecting portions of the connecting bars 14 are inserted through the upper flanges 1b and girder bodies, and stoppers such as the nuts 15, etc. are seated on the upper flanges 1b and the girder bodies.

[0049] In an example of Fig. 8, an elongate seat plate 20 extending in the bridge width direction is mounted on upper surfaces of the bridge girders 1, or upper surfaces of upper flanges 1b in case of H-steel bridge girders, the upper end projecting portions of the connecting bars 14 are inserted through through-holes provided in the elongate seat plate 20, and nuts 15 are threaded onto the upper end projecting portions (male thread portions) on an upper surface of the seat plate 20 to be seated on the elongate seat plate 20.

[0050] In addition, the connecting bars 14 partially ex-

tend through that portion of the connection concrete 11, which corresponds to the slab concrete 3, to project upward through the upper openings 5, the upper end projecting portions of the connecting bars 14 are inserted through the through-holes provided in the elongate seat plate 20, and nuts 15 are threaded onto the upper end projecting portions (male thread portions) on the upper surface of the seat plate 20 to be seated on the elongate seat plate 20.

[0051] Figs. 1 and 3 show specific examples of the connecting bars 14. As illustrated in Fig. 1, for example, a reinforcing bar is bent into U-shape to form two connecting bars 14 connected to each other, and the respective connecting bars 14 are embedded longitudinally in the concrete bridge piers 2 to be connected to the bridge girder portions 1' with upper ends thereof embedded in the connection concrete 11.

[0052] Also, as illustrated in Fig. 3, a plurality of discrete connecting bars 14 are used, and the respective connecting bars 14 are embedded longitudinally in the concrete bridge piers 2 to be connected to the bridge girder portions 1' with upper ends thereof embedded in the connection concrete 11.

[0053] Also, in the case where the concrete bridge piers 2 are supported on the upper ends of the sheet piles 12 as shown in Fig. 1, sheet pile connecting reinforcing bars 19 extending through the upper ends of the sheet piles 12 are assembled between two connecting bars 14, which are bent into U-shape and connected to each other, and the connecting bars 14 and the upper ends of the sheet piles 12 are firmly connected to each other through concrete. That is, the concrete bridge piers 2 are firmly connected to the upper ends of the sheet piles 12 by the connecting bars 14 and the sheet pile connecting reinforcing bars 19.

[0054] Of course, the connecting bars 14 and the sheet pile connecting reinforcing bars 19 are arranged in plural in the bridge width direction.

[0055] The embodiment described above shows the slab concrete 3 in the case where concrete is filled in a whole volume of spaces between adjacent bridge girders 1 as shown in the figure, that is, a whole volume of spaces between side surfaces of the bridge girders 1 and deposited integrally on the roadbed concrete 6.

[0056] As a further example, it does not matter whether the slab concrete 3 extending in the bridge length direction is hammer-set and formed only in upper spaces of spaces between the bridge girders 1, no concrete is hammer-set in lower spaces of the spaces and the lower spaces are caused to remain in the bridge length direction, or a lightweight material such as foam is filled in the lower spaces. In either case, the slab concrete 3 continues in spans between the bridge piers 2 and is connected at both ends thereof integrally to the connection concrete 11.

[0057] In case of using, for example, H-steel bridge girders as the bridge girders 1, the slab concrete 3 is filled closely between upper flanges 1b and lower flanges 1c thereof, or the slab concrete 3 is filled up to upper portions of web plates 1a from the upper flanges 1b and roadbed concrete 6 is deposited integrally to embed the upper flanges 1b in the slab concrete 3 and the roadbed concrete 6 while the lower flanges 1c and lower portions of the web plates 1a are exposed from the slab concrete 3 to cause lower spaces, which extend in the bridge length direction, to remain on the lower flanges 1c, that is, a lower portion of the slab concrete 3.

[0058] In the case where the slab concrete 3 is hammer-set and formed in upper spaces between the bridge girders 1 to cause lower spaces to remain, connection concrete 11 is filled in whole spaces between the bridge girders 1 in a region, in which the connection concrete 11 is hammer-set and formed, that is, in a region above the bridge bottom surfaces 10, and a part of the connection concrete 11 is caused to flow onto the bridge bottom surfaces 10 through the lower openings 5' to be concrete-joined.

[0059] As described above, a term for the concrete bridge piers 2 generally refers to an abutment and a bridge pier in the best mode for carrying out the invention.

Claims

1. A floor slab bridge structure wherein slab concrete is hammer-set between sides of respective bridge girders, which are aligned in a bridge width direction, in a length direction of the bridge girders and connection concrete, in which bridge girder portions supported on bridge bottom surfaces of concrete bridge piers supporting the bridge girders are embedded, is additionally deposited on the bridge bottom surfaces to form a rigid joining structure, in which the slab concrete and the concrete bridge piers are concrete-joined together through the connection concrete.

2. The floor slab bridge structure according to claim 1, wherein the concrete bridge piers are supported on upper ends of sheet piles.

3. The floor slab bridge structure according to claim 1, wherein sleeper materials are provided on the bridge bottom surfaces of the concrete bridge piers to support the bridge girders and the sleeper materials are embedded in the connection concrete.

4. The floor slab bridge structure according to claim 1, wherein the bridge girder portions supported on the bridge bottom surfaces of the concrete bridge piers and the concrete bridge piers are connected to each other by connecting bars, which are embedded in the bridge piers and the connection concrete.

FIG. 1

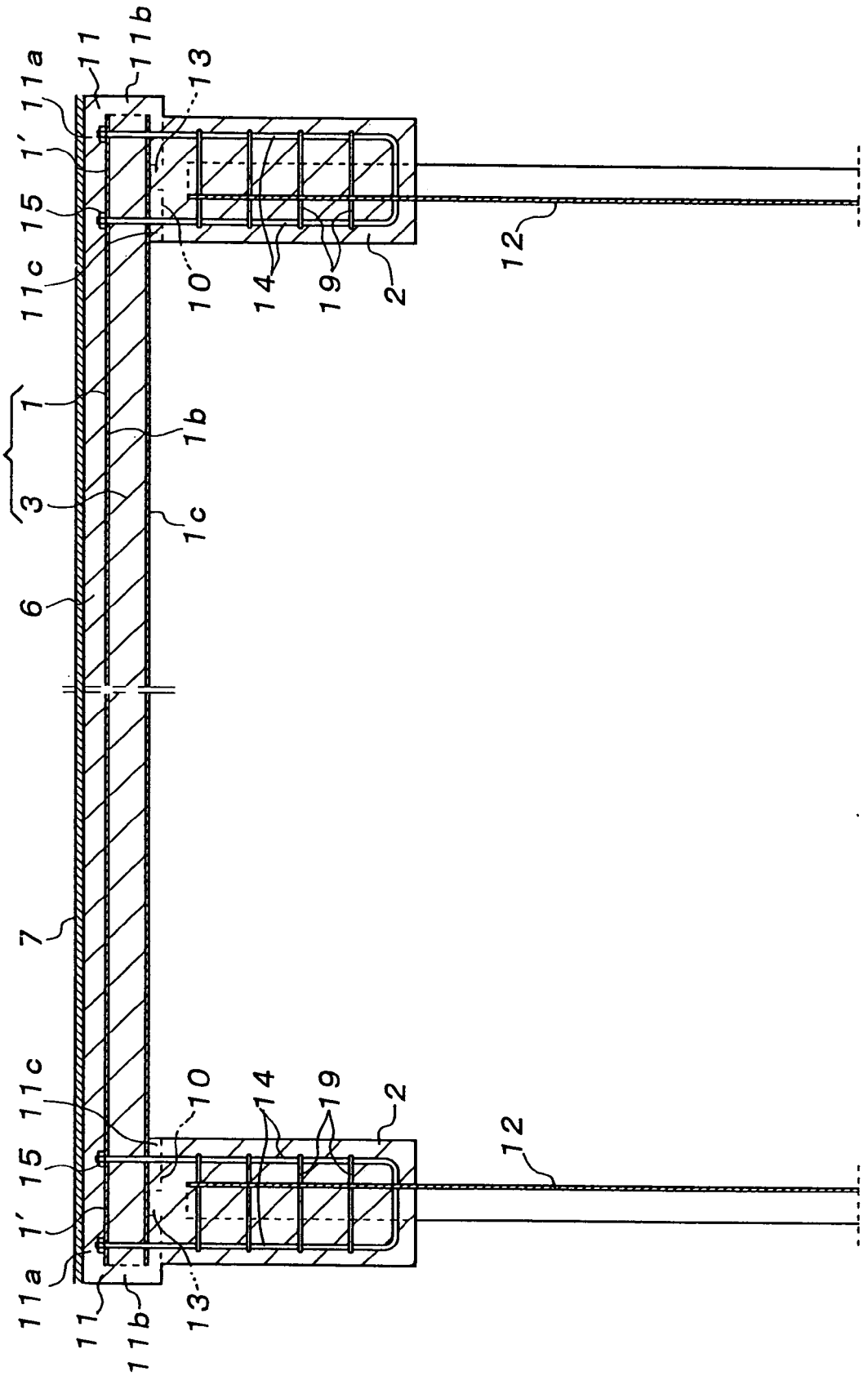


FIG. 2

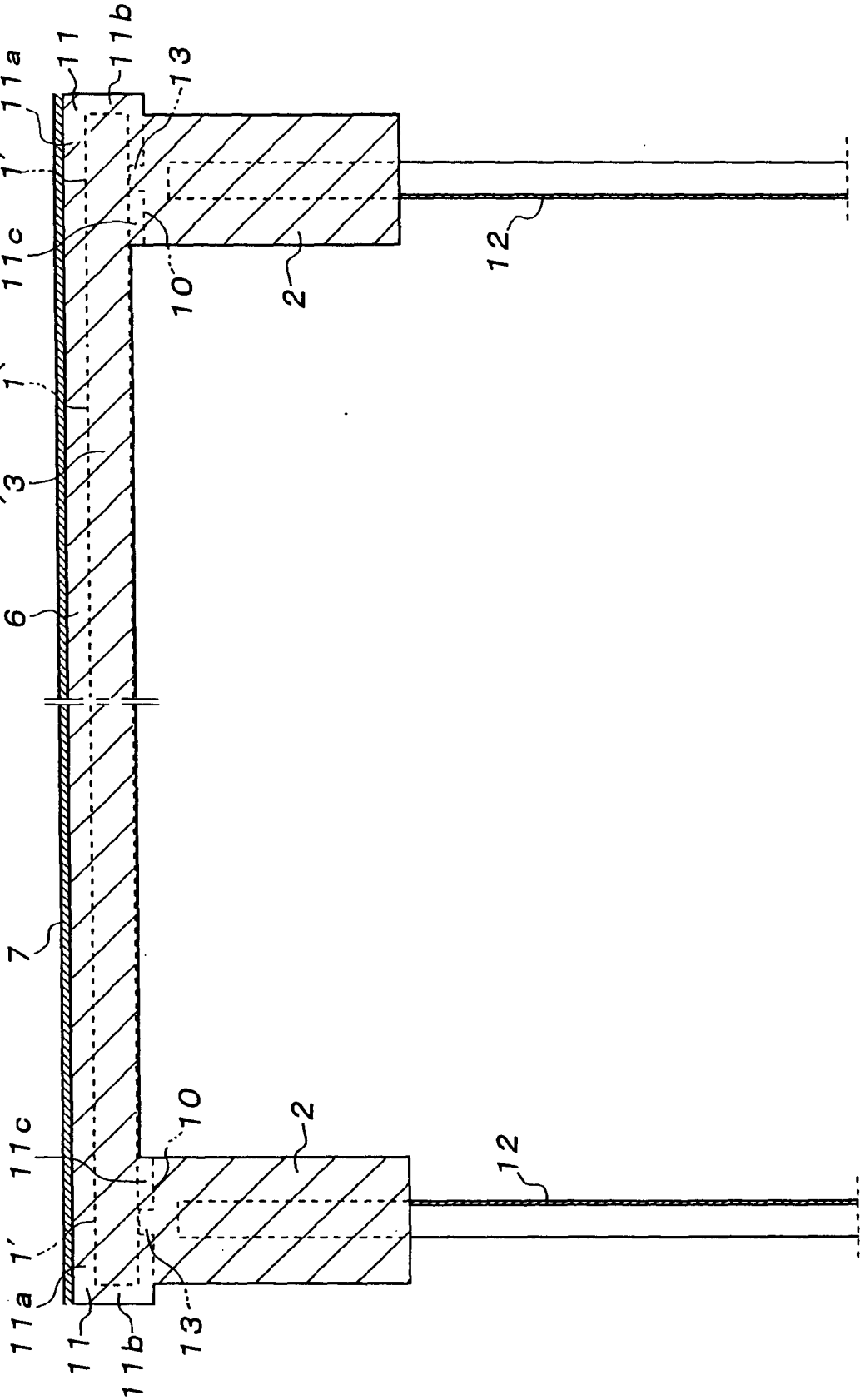


FIG. 3

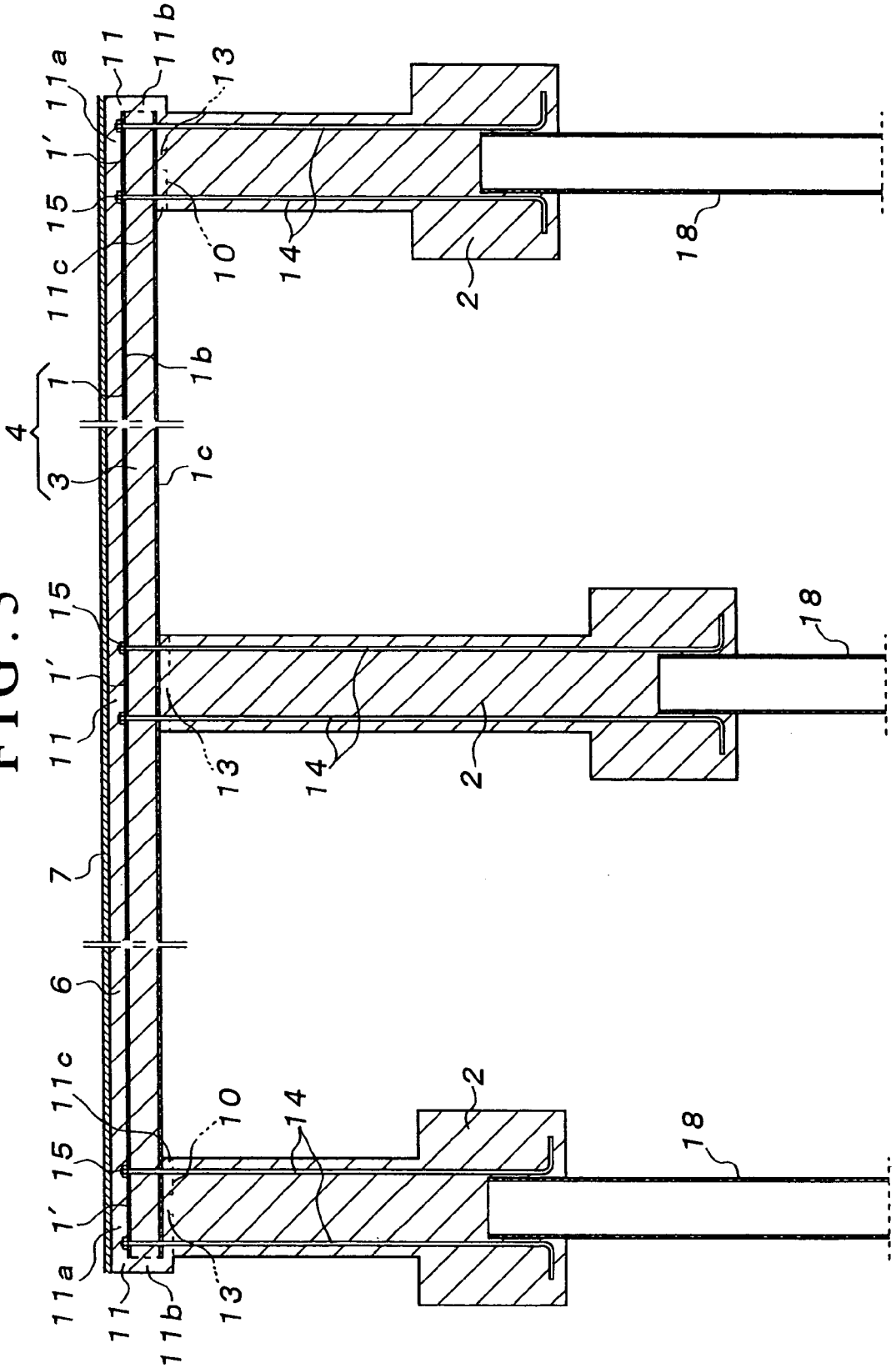


FIG. 4

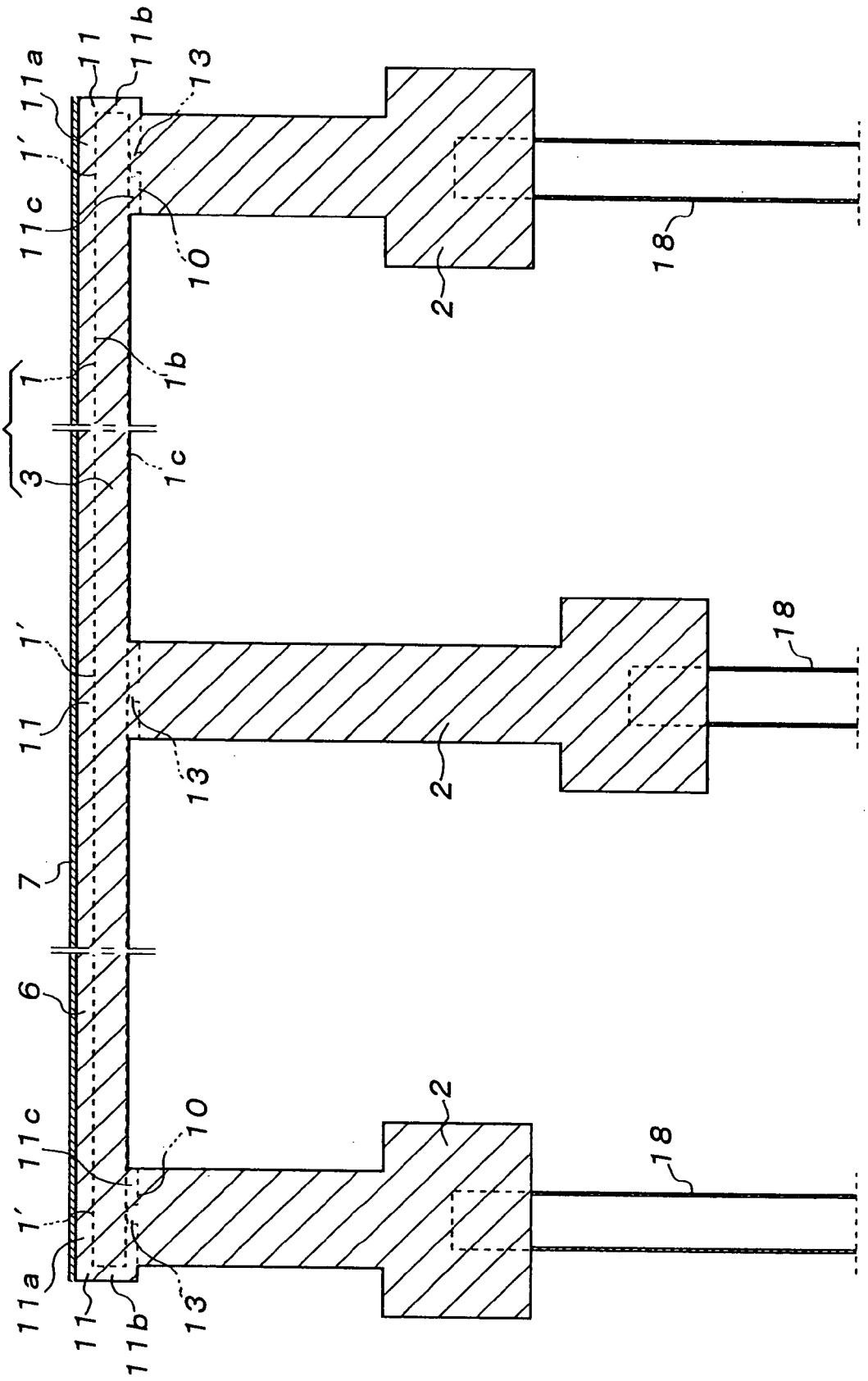


FIG. 5

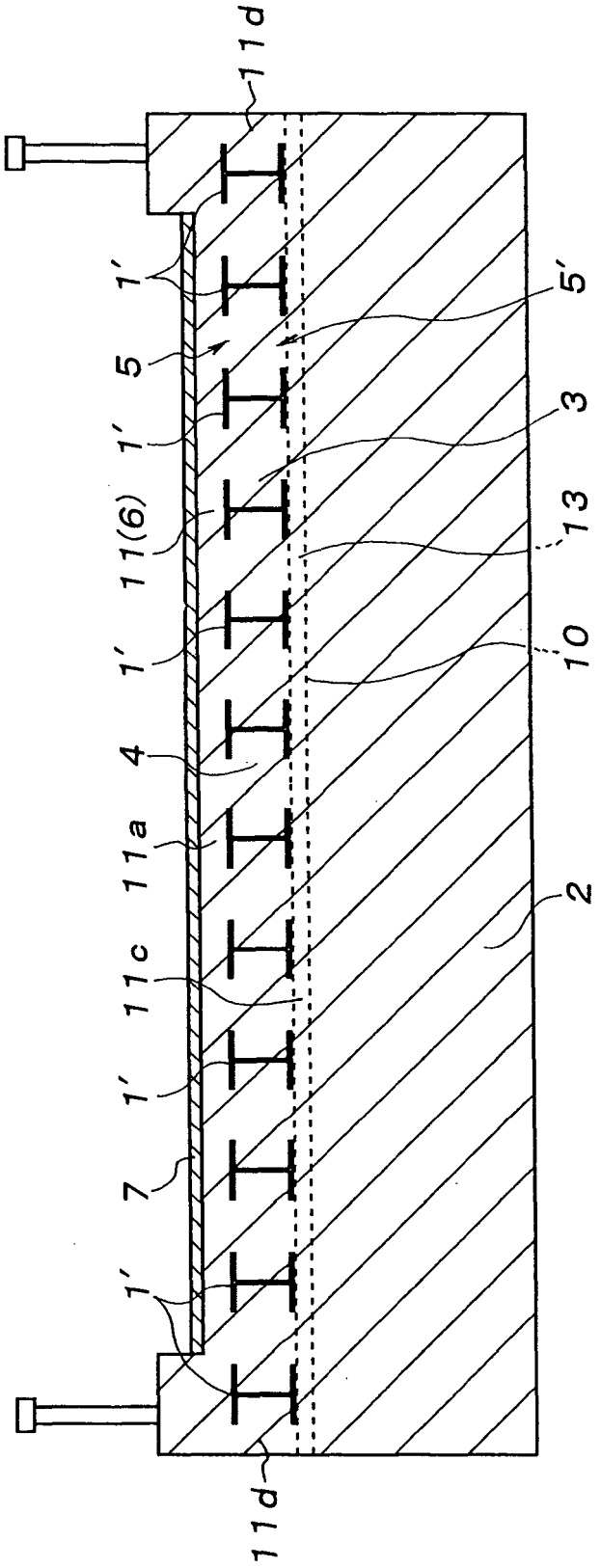


FIG. 6

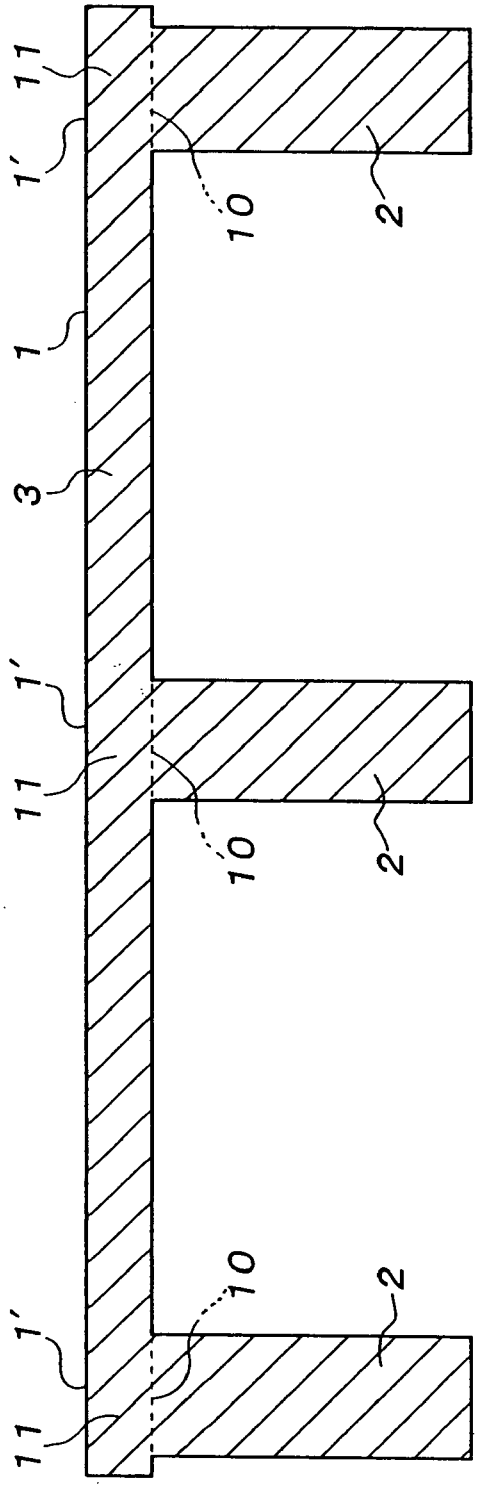


FIG. 7

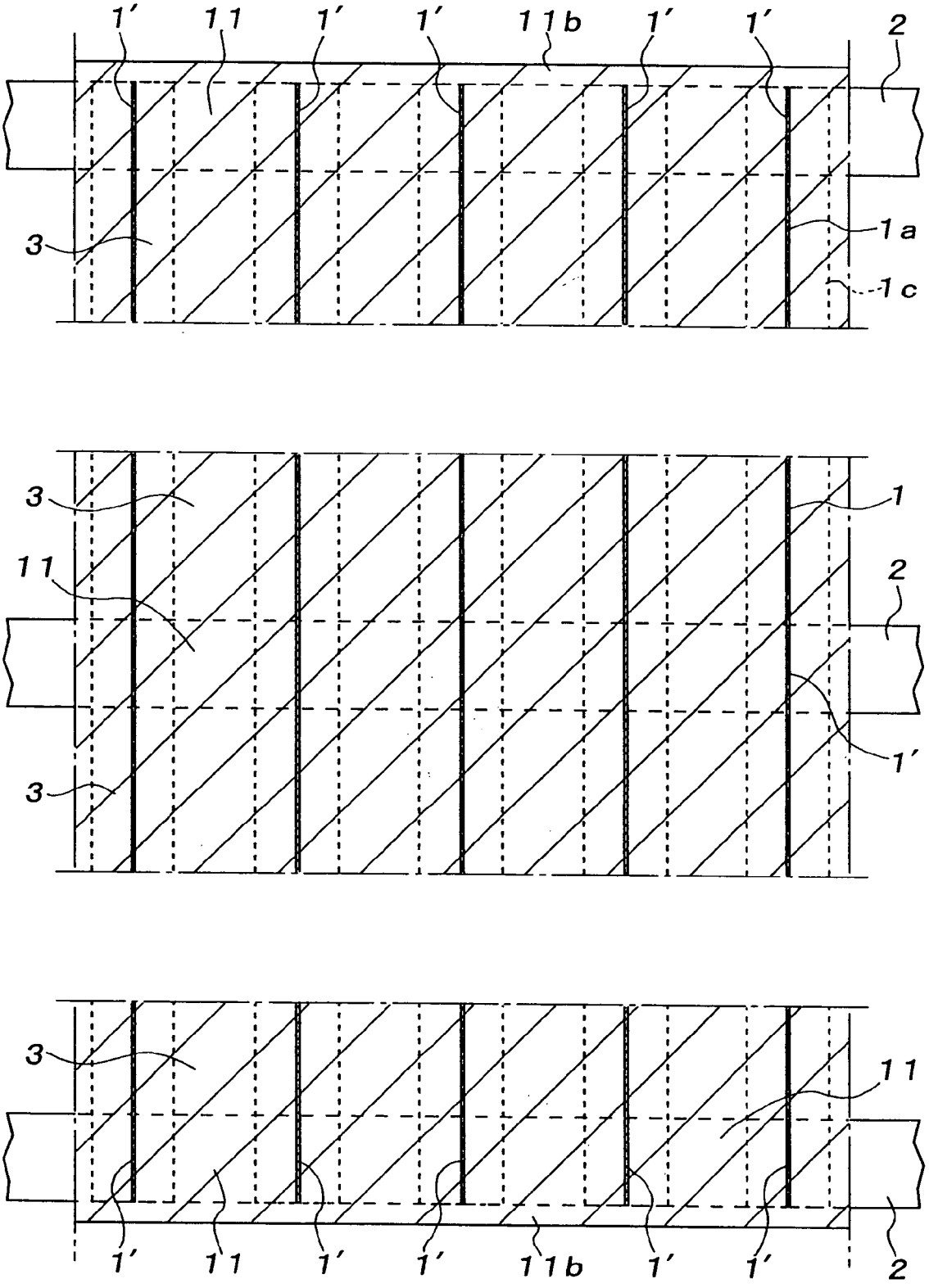


FIG. 8

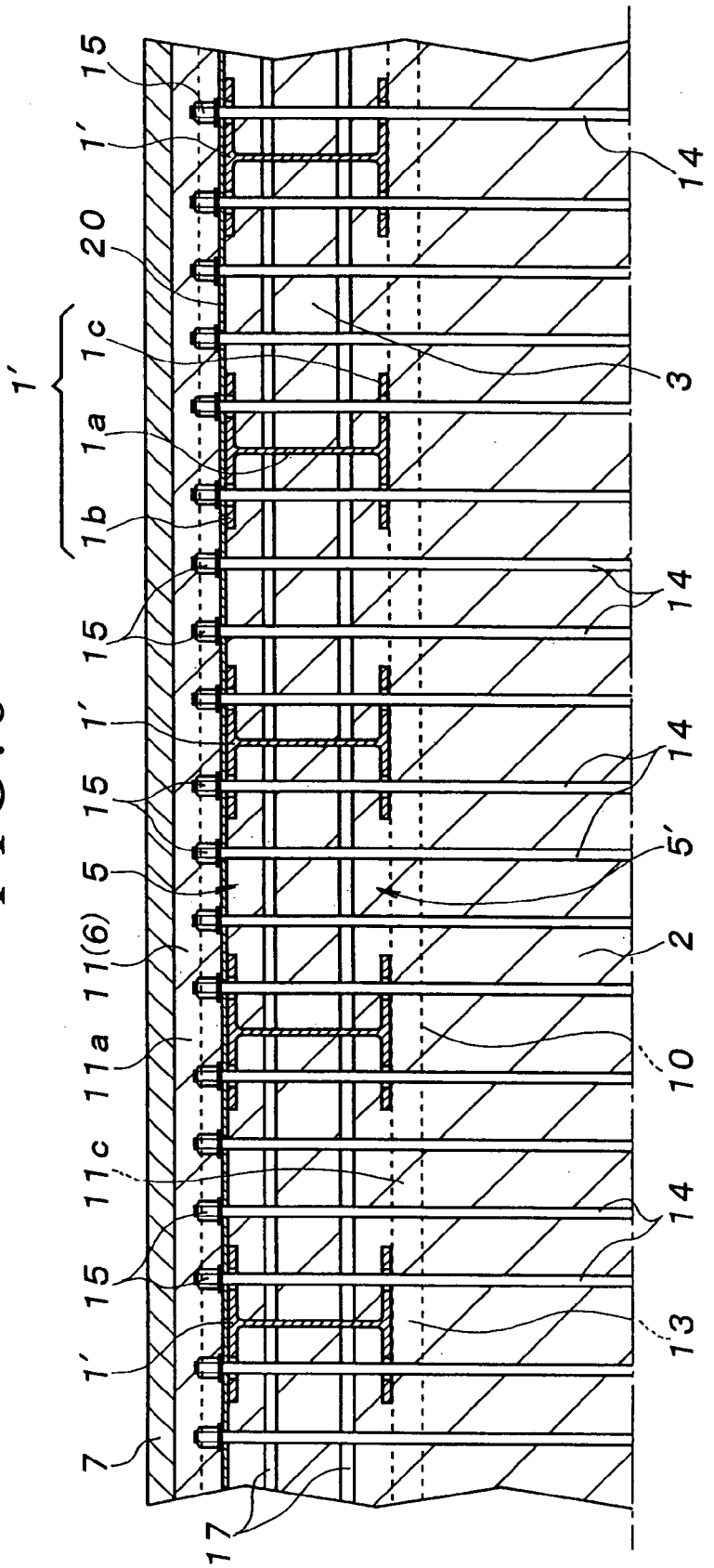
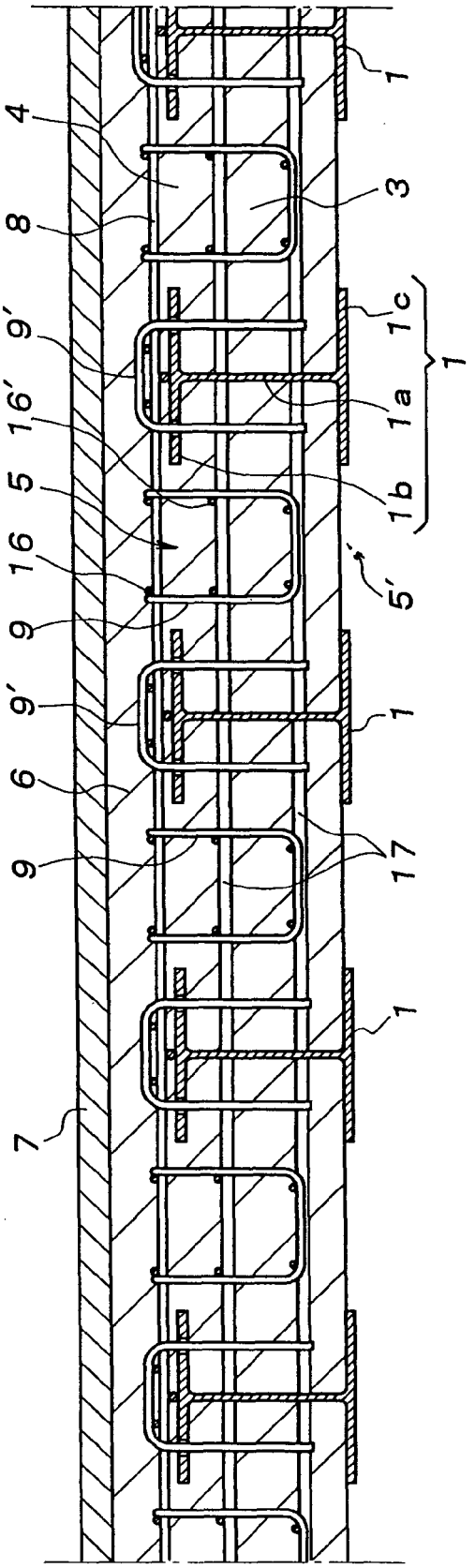


FIG. 9



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2000319816 A **[0004]**